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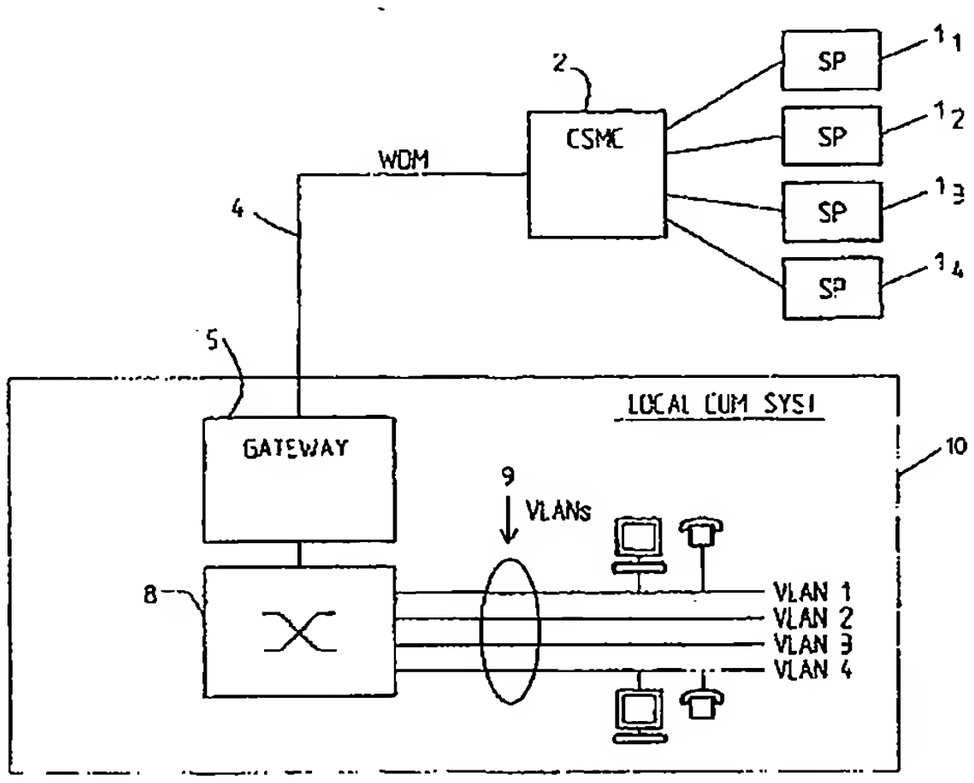

(57) Abstract: The present invention relates to an arrangement and a method for providing communication between a number of service networks (l_1-l_4) and a number of second, local, telecommunication systems (10) using a first communications system (4). The first communication system (4) is WDM-based, that a number of common service mapping centers (2) are provided, each including wavelength assignment and multiplexing means (3) for assigning specific wavelengths to a number of services/service networks (l_1-l_4) and for multiplexing said wavelengths onto transmission means of the first, WDM-based communication system (4). A number of gateway arrangements (5) are connected to the transmission means, each gateway arrangement including wavelength (de)multiplexing means (6) and channel allocation means (7) for directly mapping the assigned, specific wavelengths onto predetermined virtual broadcast domains (VLAN1-4) of a second, local communication system (10) to provide services to end users of the local communication systems.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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Title:
ARRANGEMENT AND METHOD RELATING TO SWITCHED TELECOMMUNICATIONS

FIELD OF THE INVENTION

The present invention relates to the provision of communication between a number of service networks and a number of second, local telecommunication systems using a first telecommunications system using a first communication protocol. The invention also relates to a method of providing communication between a number of service networks and a number of second, local telecommunication systems using a first communication system. Particularly it relates to providing end users with services.

STATE OF THE ART

Due to the exceedingly fast development within the fields of data and telecommunication, it has become possible to deliver more services to users. One and the same network can be used to provide users with different services and it has become possible to customize the offering of services. Customization is enabled on different levels, to individual users or to groups of private users, to companies, to individual users or groups of users within the companies etc.

One technique that is known to use to distribute services to users is based on using so called Virtual Broadcast Domains. More commonly is referred to Virtual Local Networks which is a subgroup of virtual broadcast domains. Virtual Local Networks are sometimes denoted VLANs (Virtual Local Area Network). VLAN is a marketing term used by most switch manufactures but it is not defined in detail. This means that different manufacturers can use the same term without their equipments being compatible. Below a broad

definition covering the equipment of most manufacturers is given: VLAN is a logical layer two (link layer) broadcast domain. The selection from the total broadcast domain, i.e. all ports and MAC-addresses (Medium Access Control), can be done in different ways, namely through selecting a group of ports, through selecting a group of MAC-addresses, or through selection of a protocol, for example IP or IPX. The standard IEEE 802.1Q, is based on standard LAN-switches according to IEEE 802.2-Standards. Switches implementing IEEE 802.1Q are in principle compatible with the standard IEEE 802.1D (LAN-switches) which are modified in that the rules relating to input/output data packets are modified and, an additional protocol to identify the LAN-capability of other switches and connected end user systems is provided. Furthermore a VLAN transport mechanism is provided according to which data packets are VLAN marked using specific identification bits in the packets.

The standard IEEE 802.1D describes how a LAN-switch should act. A LAN-switch should deliver user data at layer two of the OSI-stack, based on MAC-addressing. Rules are given relating to logical ports etc.

Virtual Local Networks are used to reduce costs for changing, adding or moving end user equipment for example within companies. For example all users and resources of a particular department within a company can be associated to one VLAN. In that manner it gets possible to add or remove or change equipment, move staff etc. without changing cables, moving cables or changing access filters in IP routers etc. Various solutions are known for providing services from service networks or service providers to end users.

US-A-5 572 347 relates to a switched video architecture and it shows an integrated fibre optic telecommunications network providing switched video and standard narrow band telephone services. This solution is integrated in so far that it transmits video services on the same fibre as narrow band services and it uses common equipment to support both this services. Frequency division multiplexing of the narrow band telephone service and control signals with FM channels for video distribution is used. This solution is however not flexible enough and exclusively it relates to some specific services and it leaves a lot to desire. Also other systems are known, such as EP-A-0 730 383, which shows a distributed system architecture for digital broadcast and interactive services. The system also uses frequency division multiplexing to facilitate analog distribution and to make it compatible with distribution systems providing analog services. The system is also not sufficiently flexible and it is only intended for video services.

SUMMARY OF THE INVENTION

It has been realized that local systems, such as Broadband Ethernet access systems, could be used to provide a path for the Service Provider all way to and from the end user over a common system. Ethernet based VLAN technology could e.g. be used within the local systems. However, it should be disadvantageous in that it is expensive since all service providers should need to install a proprietary fibre or fibres (or other cables) all the way from their respective service centers to the router switch of the local system. Thus, such a solution should not be entirely satisfactory. What is needed is therefore an arrangement for providing communication between service networks, particularly service providers and local communication systems using a first telecommunications system such that services can be provided to end users in a cheap and easy manner. An arrangement is also

needed through which service networks and service providers are able to transfer services (requiring unidirectional or bidirectional communication, depending on which is the service) to end users in an efficient, safe and flexible manner. An arrangement is also needed through which it is possible to provide new services to end users, to make it possible for new service providers or service networks to provide their services to end users etc. An arrangement is also needed through which the maintenance costs are low for the service networks or service providers as well as an arrangement which is easy to build out, install etc. A method fulfilling the objects mentioned above is also needed. Particularly a solution is needed through which service networks, service providers in an easy, cheap and flexible manner are enabled to provide services to end users and through which, at the same time, the end users can select the currently needed services.

Therefore an arrangement is provided through which service networks, or particularly service providers, use a common first telecommunication system based on Wavelength Division Multiplexing (WDM) to reach local communication systems. According to the invention services are delivered over the WDM-based system to which the service network connects, and the wavelength channels carrying the respective services are mapped directly on virtual broadcasting domains within the second, local telecommunication systems. (Of course the concept covers services requiring bidirectional communication, such as e.g. telephony.)

A number of service networks are connected to one, or more, common first telecommunication systems which is/are WDM-based. A number of common service mapping centers are provided which include wavelength assigning means and multiplexing means for assigning specific wavelengths to a number of services/service networks and

for multiplexing said wavelengths onto transmission means of the first, WDM-based, communication system.

A number of gateway arrangements are connected to the transmission means and each gateway arrangement includes wavelength (de)multiplexing means and routing/switching means for mapping or allocating the assigned specific wavelength channels directly onto predetermined virtual broadcast domains of a local communication system such that services can be provided to end users of the local communication systems. Particularly each gateway arrangement is connected to a switch for connecting the gateway to a switched domain. The virtual broadcast domains particularly comprise virtual local networks also called VLANs. The service networks particularly comprise service providers.

A Swedish Patent Application "ANORDNING OCH FÖRFARANDE VID SWITCHAT TELEKOMMUNIKATIONSSYSTEM", filed on June 15, 1999 by the same applicant solves the problem of, for an end user of a telecommunication system, selecting desired services amongst a plurality of offered services which are delivered on service networks by service providers. The service networks are grouped into service network groups with a desired content of services. The service network groups are assigned specific virtual broadcast domains carrying information from their respective service network group. The end users can then select services through selecting one or more of the virtual broadcast domains. According to this application different service networks such as for example telephony networks, Internet, cable TV networks, alarm or security networks etc. are connected to a switched domain, e.g. via a router. Through selections among the service networks these are arranged in service network groups in the desired manner. Each service network group is assigned at least one virtual broadcast domain through configuration of ports at the switches in the

switched domain. End users can then select service network group through selecting one or more of the virtual broadcast domains. The switched domain has a device connection to which the end user can connect apparatuses and connects the selected virtual broadcast domain through configuration of the switch ports. When an end user wants to change the services, another virtual broadcast domain can be selected etc. It is done through reconfiguration of the ports of the switches and reconfiguration at the end user side. The service networks are separated from each other also on the virtual broadcasting domains since a specific type of connection elements, so called hubs, are excluded from the switched domain. In this document as well as in the present invention the term telecommunications system is given a very broad definition and it covers for example telephony systems, data communication systems, video communication systems and telemetric systems etc. This document is herewith incorporated herein by reference thereto. Although the present invention is not limited to any particular way of assigning or distributing services or service network groups on virtual broadcasting domains and virtual LANs or to how the end user can select services etc., it may with advantage be combined with the solution as disclosed in the above mentioned document resulting in apparent advantages for the service providers as well as for the end users.

In a particular implementation of the present invention the virtual broadcasting domains consist of virtual local area networks also called VLANs as also described in the above mentioned patent application. The service networks particularly comprise service providers. According to the inventive concept each service provider, or service network in more general terms, is connected to a Common Service Mapping Center (CSMC) and assigned one or more wavelengths in the common service mapping center. This means that a service provider can subscribe to one or

more wavelengths. The wavelength assignment or subscription, in the common service mapping center, can be done in different ways. One service provider may be assigned (i.e. subscribe to) a plurality of wavelengths. Wavelengths may also be assigned to different services as provided by one and the same service provider etc. It is also possible that one service by the same or by different service providers is assigned one or more wavelengths.

In a particular implementation the common service mapping centers, also called teleports or telecities, are connected to the transmission means of a first communication system which transmission means comprises a wavelength multiplexed optical fiber. It may also be copper based. Any other appropriate physical means can also be used, e.g. the air. Thus a number of service providers or service networks use one and the same transmission medium of one and the same communication system to transfer their services to one or more local communication systems, for example through simple subscription to one or more wavelengths. According to different embodiments the WDM-based communication system may comprise a point-to-point transmission network. Alternatively it comprises a ring network or a star-shaped network. Particularly the first communication system is a Metropolitan Area Network. If the WDM-based communication system comprises a point-to-point transmission network, the multiplexing means of the common service mapping center particularly comprises an Optical Terminal Multiplexer whereas the demultiplexing means of the gateway arrangement, on the other hand, comprises another Optical Terminal Multiplexer (both OTMs providing for multiplexing as well as demultiplexing depending on direction of communication). If the WDM-based communication system comprises a ring network, the demultiplexing means of the gateway arrangements advantageously comprise so called Optical Add Drop Multiplexers (OADM) wherein

the relevant wavelength are dropped whereas the others are sent on to a subsequent OADM in which they are to be dropped, (or added for traffic in the opposite direction).

The service networks or the service providers may use the same or different protocols. Protocols that can be used are for example PDH (Plesiochronous Digital Hierarchy), SDH (Synchronous Digital Hierarchy), SONET, ATM (Asynchronous Transfer Mode), Ethernet, IP (Internet Protocol), DTM (Dynamic synchronous Transfer Mode) etc. The WDM transport channels in an advantageous implementation comprise so called E1 channels, i.e. 2Mbps channels based on for example ATM, SDH, DTM or PDH. Of course also E2, E3, E4, E5 channels etc. can be used. The communication protocol or the transport protocol used as the WDM-channel in advantageous implementation comprises IP over WDM. But it may also be any other appropriate protocol, the main thing being that the routing/switching device of the gateway arrangement is able to handle such protocol. In a most particular implementation Ethernet over WDM is implemented.

In a particularly advantageous implementation, the local telecommunication systems comprise broadband access systems.

In advantageous implementations the local communication systems use Ethernet VLAN technology. Alternatively other link layer techniques can be used such as Token Ring and FDDI. It is also possible to use ATM. Over ATM (link layer) it is possible to use the by ATM forum defined standard LAN Emulation, LANE. Also LANE includes the functionality of creating logical broadcast domains over a link layer structure. This is possible even if ATM, as opposed to for example Ethernet and Token Ring, is a switched technique and not a broadcast technique.

In a particular implementation each wavelength on the WDM transport channel is assigned a separate input port at the routing/switching device of the gateway arrangement.

In one implementation the service networks or the service providers are dedicated or assigned a broadband channel all the way to the end users over the WDM-based first communication system.

Most advantageously the first communication system is IP-based, i.e. it uses TCP/IP (Transmission Control Protocol/Internet Protocol) and each routing device advantageously comprises an IP-router.

Therefore also a method as initially referred to is provided, which includes the steps of; assigning one or more specific wavelengths to each service network or specific service(s) of a service network; multiplexing the assigned specific wavelengths; transferring the multiplexed signal comprising the specific wavelengths over the first telecommunication system, which is WDM-based, to a gateway arrangement; demultiplexing the wavelength-multiplexed signal; assigning a virtual broadcasting domain to each wavelength; transferring services to respective end users using the appropriate virtual broadcasting domain.

In a particular implementation the method includes the steps of: for a ring-shaped network; dropping relevant wavelengths at an Optical Add Drop Multiplexer; demultiplexing the dropped wavelengths in the OADM; sending the other wavelengths on to other OADM:s until they are to be dropped. Preferably TCP/IP is used as a communication protocol by the first communication system (and the service networks and the local communications systems).

A method of transferring services from service networks/service providers to end users in local communication networks is also provided, including the steps of; assigning one or more specific wavelengths to each of a numbers of services/service providers in a common service mapping center; multiplexing the specific wavelengths; using a WDM-based communication system to transfer the multiplexed wavelength signal to a gateway arrangement of/connected to, a local communication system; demultiplexing the signal; assigning each of a number of the services/service providers to a virtual broadcast domain; routing/switching the services/service providers to the intended end user(s) having selected one or more virtual broadcasting domain. In particular the virtual broadcasting domains comprise Virtual Local Area Networks based on Ethernet technology, ATM, Token Ring, FDDI or any other link protocol supporting forming of logical domains. It is an advantage of the present invention that service providers can use common systems to reach local systems which strongly contributes in reducing the costs. It is also an advantage that service providers, particularly broadband service providers, can be connected to local systems or broadband islands in a cheap manner. It is also an advantage that it is possible to offer a dedicated broadband channel for service providers over common equipment to and from consumers/end users.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will in the following be further described in a non-limiting manner and with reference to the accompanying drawings, in which:

Fig. 1 for explanatory reasons, shows how service providers can be connected to end users,

Fig. 2 illustrates how service providers can be connected to end users according to a first embodiment of the present invention,

Fig. 3 schematically illustrates a block diagram of a communication structure with different layers,

Fig. 4 shows a more detailed block diagram of the arrangement for providing communication between service providers and a local communication system,

Fig. 5 shows an implementation of the inventive concept to a ring-shaped first communication system,

Fig. 6 is a flow diagram illustrating connection of service providers to a local network, and

Fig. 7 is a very schematical flow diagram illustrating how end users can get access to specific services according to a particular implementation.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 is a simplified view of a system wherein a number of service providers SP01, SP02, SP03, SP04 have installed their own fibres L1, L2, L3, L4 or cables all the way from their respective service centers to a local communication system, i.e. to a switch X (or a router) of a local communication system with a number of end users. However, this is an expensive solution and moreover it is inflexible as discussed earlier in the application.

Generally a number of different telecommunication services and a number of data communication services are available over different service networks or from different service providers (of course

some service providers may also provide different services). Moreover, different users or end users have the option to select one or more services and subscribe to them. The end user may be a private person or belong to some kind of a group, both private groups or groups within a company, or it may comprise a whole company etc. It may also be an area with domiciles.

In Fig. 2 four service networks, or particularly service providers $SP1_1$,$SP1_2$, $SP1_3$, $SP1_4$ are connected to a Common Service Mapping Center 2. There may of course be more (or fewer) than four service providers. In the common service mapping center 2, hereinafter denoted CSMC, $SP1_1$, $SP1_2$, $SP1_3$, $SP1_4$ are each assigned one or more wavelengths. In principle the different service providers may subscribe to an optional number of wavelengths. Then the services or service providers (their assigned wavelengths) are connected to a wavelength multiplexed optical fiber (or a copper wire or any other appropriate physical transmission media) and the transmission means of a first communication system, here a point-to-point network 4 which is WDM (Wavelength Division Multiplex) based, is used for transportation of the services towards the end users of local communication systems. It also allows communication from the end users to the service providers, e.g. if some particular services require responses from the end users, or for other reasons, e.g. for telephony which generally is based on two-way communication.

The local communication system 10 here comprises a gateway arrangement 5 wherein the wavelengths are assigned or connected to respective Virtual Local Area Networks (VLAN) 9 of the local communication system 10. Via the gateway arrangement 5 the wavelengths carrying the services of for example one service network group are connected, via switch 8 connecting to a switched domain or comprising a switched domain, connected to specific

VLANs, VLAN1, VLAN2, VLAN3 or VLAN4. In a particular implementation Ethernet Technology is used for the virtual local area networks and the switch is an Ethernet switch. How certain network groups are formed, and if, does not form part of the present invention. In an advantageous implementation, however, at least two service network groups, wherein each service network group is a selection amongst the service networks, and wherein ports for the service networks of a predetermined service network group, are configured to belong to at least one Virtual Local Area Network VLAN. Means are also provided for configuration of the port for user machines such as telephones, computers, internet, cable TV etc. to at least one predetermined VLAN. The ports are reconfigurable. This is described in the swedish patent application referred to earlier in the application and which was incorporated herein by a reference thereto. But, this can be done in any appropriate manner.

Moreover it does not have to be Ethernet VLANs but it may also be for example ATM (Asynchronous Transfer Mode) PVC or SPC channels (Permanent Virtual Channels or Switched Virtual Channels) that are used to the respective end users, i.e. the virtual broadcasting domains may comprise PVCS or SPCs.

Irrespectively of which is the kind of communication, such as telephony, data, video, telecommunication, the communication is divided into a layered structure as shown in Fig 3. Each layer has its specific task towards overlaying and underlaying layers and together the layers form a stack. Within the Internet technology the so called TCP/IP-stack 20 is used. The communication model shown in Fig.3 contains five layers, namely layer 21 which is the application layer. It is defined by a user process which communicates with another process. The other process may for example be e-mail via the SMTP protocol or it may relate to

surfing on the Internet using the HTTP protocol. The transport layer 22 is defined by the fact that control of the transmission of data between end stations can be introduced. The Transmission Control Protocol (TCP) offers a secure transmission of data between the user processes whereas UDP (User Data Protocol) does not. Moreover, in this layer a concept "port" is introduced or defined which however should not be erroneously be taken for a port belonging to a switch. Port in this context has as its task to distinguish between processes in one and the same machine which use the same transport protocol.

The subsequent layer 23 is the Internet layer. The Internet Protocol IP defines this layer. On this level it is possible to offer routing through so called IP routers. The IP protocol, IP addressing and the IP router with IP routing protocols belonging thereto provides the scalability of todays Internet. The IP protocol does not offer any secure transmission. This is handled by overlying protocols, for example TCP, or if UDP is used, application protocols. The next layer 24, the link layer, is a layer defining connection to the physical medium over which data is to be transported. The layer may, but does not have to, offer secure transmission. Furthermore it may implement packet switching or circuit switching. IP leaves it open. Typical link techniques are Ethernet, ATM, frame relay etc. Layer 25 is the physical layer. This layer describes the physical medium which may be an optical fiber, copper, the air etc.

Fig. 4 shows more in detail one embodiment similar to that of Fig. 2 wherein a number of service providers are connected to an CSMC 2 using a WDM-based communication system, here a point-to-point network as in Fig. 2 for communication of services to a local communication system, not shown except for the gateway arrangement 5 and the switch 8.

Service providers $SP1_1$, $SP1_2$, $SP1_3$, $SP1_4$, $SP1_5$, $SP1_6$, $SP1_7$ in the illustrated embodiment use different communication protocols. This figure is merely taken to illustrate that different protocols can be used and that generally different service providers using different protocols all can be connected to one and the same CSMC 2 in order to subscribe to wavelengths. Here it is supposed that $SP1_1$ uses PDH (Plesiochronous Digital Hierarchy) and is assigned a first wavelength λ_1, $SP1_2$ uses SDH (Synchronous Digital Hierarchy) and is assigned a wavelength λ_2, whereas $SP1_3$ uses SONET and is assigned a wavelength λ_3. $SP1_4$ uses ATM and is assigned a wavelength λ_4, $SP1_5$ uses Ethernet and is assigned a wavelength λ_5, $SP1_6$ uses IP (Internet Protocol) and is assigned wavelength λ_6 whereas $SP1_7$ uses DTM and is assigned wavelength λ_7. Of course one or more of the service providers may be assigned more than one wavelength.

In Optical Terminal Multiplexer (OTM) the different wavelengths are multiplexed and output on a WDM-based, point-to-point transmission network. The other end point is here supposed to be a local communication system with a gateway arrangement 5. In the gateway arrangement 5 another Optical Terminal Multiplexer (OTM) 6 is provided in which the wavelength multiplexed signal from OTM 3 is demultiplexed and each wavelength is allocated or mapped onto one channel, i.e. the opposite procedure of that as disclosed with reference to the CSMC 2. The wavelength carrying the different services are input to a channel mapping (allocating) means 7 wherein each wavelength is mapped onto one of VLAN 1 - VLAN 7. The channel mapping means may comprise a router but it may also comprise for example an Ethernet switch or any other switch able to handle such a mapping. From switch 8 the services carried by the VLANs are delivered to the respective end users. For

communication in the other direction from the end user to the service provider, the respective OTMs operate in the opposite way.

It should be clear that in the above described embodiment, some or all service providers may of course use one and the same communication protocol or some of them may use the same protocol and they may also subscribe to any number of wavelengths, include one or more services for delivery to end users and the invention is also not limited to any particular number of service networks or service providers that are handled in CSMC but it is given by the physical and practical performance of the multiplexing means that are used and on the WDM-based communication system. Thus CSMC may also include more than one multiplexer just as well as the gateway arrangement may include more than one (de)multiplexer.

Fig. 5 schematically illustrates one embodiment of the invention wherein the first communication system comprises a ring network such as a Metropolitan Area Network. Service providers $SP1_{11},...,SP_N$ are assigned wavelengths in a CSMC 2A as described with reference to Fig. 4. Here the services can be provided to three different local communication systems $10A_1$, $10A_2$, $10A_3$ (substantially any number is possible). The functioning is substantially the same as that described with reference to the point-to-point network but the demultiplexing means of the respective gateway arrangements $5A_1$, $5A_2$, $5A_3$ comprise Optical Add Drop Multiplexers (OADM) $6A_1$, $6A_2$, $6A_3$ wherein the appropriate wavelengths are dropped or inserted (added) for communication in the other direction. The OADMs are connected to channel mapping means $7A_1$, $7A_2$, $7A_3$, e.g. routers or switches which in turn are connected to switches $8A_1$, $8A_2$, $8A_3$ for output on the respective assigned VLANs $9A_1$, $9A_2$, $9A_3$ respectively. The switching means $8A_1$, $8A_2$, $8A_3$ are in principle so called Ethernet switches if the Ethernet technology is used. Instead of

switches, routers may be used. In still other implementations is possible to have for example more than one CSMC.

In still another implementation, which however not is illustrated herein since it should be obvious to the man skilled in the art how the inventive concept would be implemented, the first communication comprises a star-shaped network.

Fig. 6 illustrates, in the form of a flow diagram, the inventive procedure according to which a number of service providers can provide services to a local group of end users. As from the starting point, 100, it is supposed that a number of service providers, at least two, are connected to a common service mapping center, 110. In the CSMC each service provider is assigned at least one wavelength, 120, according to his subscription. In the CSMC, the assigned wavelengths are multiplexed, 130, and the WDM-based communication system is used for transportation of the multiplexed signal towards the local communication system, 140. When arriving at the local communication system, the wavelength multiplexed signal is demultiplexed in a demultiplexer of a gateway arrangement to a local communication system, 150. The gateway arrangement may be included in the local communication system or it may be provided externally thereof, 150. The respective wavelength channel or channels of which service provider are then mapped onto specific VLANs of the local communication system, 160 and finally the end users are provided with the appropriate services, 170, which is illustrated within dashed lines, since this can be done in any appropriate manner.

Fig. 7 is a flow diagram, which is a summary of one preferred embodiment, describing how the end users can be connected to certain services, as disclosed in the earlier mentioned

incorporated patent application. In a first step 171 a number of service network groups are formed from selected service networks/ service providers. The virtual local networks are defined in the subsequent step 172, there upon the ports over which the respective service network groups can be accessed, are configured to belong to respective virtual local network VLAN. Then an end user is assigned an address that corresponds to the selected virtual local network, 174. Service network groups can be changed. Then the last two steps have to be repeated.

The invention is of course not limited to the explicitly illustrated embodiments but it can be varied in a number of ways without departing from the scope of the appended claims. Moreover, some services are bidirectional or require responses from the end users, i.e. a two-way communication, and the functioning is in principle the opposite in the respective mapping arrangements, i.e. the mapping means mapping an input wavelength channel onto a VLAN and the procedure in the CSMC for assigning wavelengths etc.

CLAIMS

1. An arrangement for providing communication between a number of service networks (1_1-1_4;1_1-1_7;1_{11}-1_N) and a number of second, local, telecommunication systems (10;$10A_1$,$10A_2$,$10A_3$) using a first communications system (4),
c h a r a c t e r i z e d i n
that the first communication system (4) is WDM-based, that a number of common service mapping centers (2;2A) are provided, each including wavelength assignment and multiplexing means (3) for assigning specific wavelengths to a number of services/service networks (1_1-1_4;1_1-1_7; 1_{11}-1_N) and for multiplexing said wavelengths onto transmission means of the first, WDM-based communication system (4), and in that a number of gateway arrangements (5;$5A_1$,$5A_2$,$5A_3$) are connected to the transmission means, each gateway arrangement including wavelength (de)multiplexing means (6;$6A_1$,$6A_2$,$6A_3$) and channel allocation means (7;$7A_1$,$7A_2$,$7A_3$) for directly mapping the assigned, specific wavelengths onto predetermined virtual broadcast domains (VLAN1-4;VLAN1-7; 9;$9A_1$,$9A_2$,$9A_3$) of a second, local communication system (10;$10A_1$,$10A_2$,$10A_3$) to provide services to end users of the local communication systems.

2. An arrangement according to claim 1,
c h a r a c t e r i z e d i n
that to each gateway arrangement a switch (8) is provided for connecting the gateway arrangement (5;$5A_1$,$5A_2$,$5A_3$) to a switched domain.

3. An arrangement according to claim 1 or 2,
c h a r a c t e r i z e d i n

that the virtual broadcast domains (VLAN1-4;VLAN1-7; 9;9A_1, 9A_2, 9A_3) consist of virtual local networks (VLAN).

4. An arrangement according to any one of the preceding claims, characterized in that the service networks (1_1-1_4;1_1-1_7;1_{11}-1_N) comprise service providers.

5. An arrangement according to claim 4, characterized in that each service provider connected to a common service mapping center (2;2A) is assigned one or more wavelengths in the common service mapping center (2;2A).

6. An arrangement according to claim 4 or 5, characterized in that a number of services are grouped together and assigned one or more wavelengths in the common service mapping center (2;2A).

7. An arrangement according to anyone of the preceding claims, characterized in the channel allocation means (7;7A_1, 7A_2, 7A_3) comprises a routing device or a switching device.

8. An arrangement according to any one of the preceding claims, characterized in that the common service mapping center(s) (2;2A) is/are connected to the transmission means of the first communication system and in that said transmission means comprises a wavelength multiplexed optical fiber.

9. An arrangement according to any one of the preceding claims, characterized in

that the first WDM-based communication system (4) comprises a point-to-point transmission network, that the multiplexing means (3) of the common service mapping center (2) comprises an Optical Terminal Multiplexer (OTM) and in that the (de)multiplexing means (6) of the gateway arrangement (5) comprises another Optical Terminal Multiplexer (OTM).

10. An arrangement according to any one of claims 1-8,
c h a r a c t e r i z e d i n
that the first WDM-based communication system comprises a ring network or a star-shaped network and in that the demultiplexing means ($6A_1, 6A_2, 6A_3$) of the gateway arrangements ($5A_1, 5A_2, 5A_3$) comprise Optical Add Drop Multiplexers (OADM).

11. An arrangement according to claim 10,
c h a r a c t e r i z e d i n
that the first communication system is a Metropolitan Area Network.

12. An arrangement according to any one of the preceding claims,
c h a r a c t e r i z e d i n
that the service networks (l_1-l_4;l_1-l_7;l_{11}-l_N) use the same or different communication protocols, such as e.g. PDH, SDH, SONET, ATM, Ethernet, IP, DTM etc.

13. An arrangement according to claim 12,
c h a r a c t e r i z e d i n
that WDM transport channels comprise E1 channels (2Mbps), E2 channels (8Mbps), E3 (34Mbps), E4 or E5 channels based on ATM, SDH, DTM or PDH.

14. An arrangement according to any one of the preceding claims,
c h a r a c t e r i z e d i n

that the first communication protocol used as the WDM channel transport protocol is PDH, SDH, ATM, DTM, IP over WDM, Ethernet over WDM or any other protocol that the routing/switching device(s) ($7;7A_1;7A_2;7A_3$) can handle.

15. An arrangement according to any one of the preceding claims, c h a r a c t e r i z e d i n
that the local telecommunication systems comprise broadband access systems.

16. An arrangement according to claim 14 or 15,
c h a r a c t e r i z e d i n
that the local communication system(s) use Ethernet VLAN technology or ATM technology.

17. An arrangement according to any one of the preceding claims,
c h a r a c t e r i z e d i n
that each wavelength is assigned a separate input port at the routing/switching device ($7;7A_1;7A_2;7A_3$).

18. An arrangement according to any one of the preceding claims,
c h a r a c t e r i z e d i n
that the service providers ($1_1,-1_4;1_1-1_7;1_{11}-1_N$) are assigned a broadband channel to the end users over the WDM-based first communication system.

19. An arrangement according to claim 14,
c h a r a c t e r i z e d i n
that the first communication system is IP-based and in that each or some of the routing/switching devices ($7;7A_1;7A_2;7A_3$) comprise an IP-router.

20. A method of providing communication between a number of service networks and a number of second, local, telecommunication systems using a first telecommunication system using a first communication protocol,
c h a r a c t e r i z e d i n
that it comprises the steps of:
- assigning one or more specific wavelengths to each service network or specific service(s) of a service network;
- multiplexing the assigned, specific wavelengths;
- transferring the multiplexed signal over the first telecommunication system, which is WDM-based, to a gateway arrangement;
- demultiplexing the wavelength-multiplexed signal;
- assigning a virtual broadcasting domain to each wavelength;
- routing service(s)/service network(s) to respective end user using the corresponding virtual broadcasting domain.

21. A method according to claim 20,
c h a r a c t e r i z e d i n
that the virtual broadcasting domains comprise Virtual Local Area Networks (VLAN).

22. A method according to claim 20 or 21,
c h a r a c t e r i z e d i n
that the virtual local area networks/virtual broadcast domains are created using Ethernet, Token Ring, FDDI or ATM.

23. A method according to any one of claims 20-22,
c h a r a c t e r i z e d i n
that the WDM-based first communication system is a point-to-point transmission network.

24. A method according to any one of claims 20-22,

c h a r a c t e r i z e d i n
that the WDM-based first communication system comprises a ring or star-shaped network, e.g. a Metropolitan Area Network.

25. A method according to claim 24,
c h a r a c t e r i z e d i n
that it comprises the steps of:
- dropping relevant wavelengths at an Optical Add Drop Multiplexer (OADM) connected to a routing/switching device;
- demultiplexing the dropped wavelengths in the OADM;
- sending the other wavelengths on to other OADM:s until they are to be dropped.

26. A method according to any one of claims 20-25,
c h a r a c t e r i z e d i n
that it comprises the step of using TCP/IP as a communication protocol.

27. A method of transferring services from service networks/service providers to end users in local communication networks,
c h a r a c t e r i z e d i n
that it comprises the steps of:
- assigning one or more specific wavelengths to each of a services/service providers in a common service mapping center;
- multiplexing the specific wavelengths;
- using a WDM-based communication system to transfer the multiplexed wavelength signal to a gateway arrangement of/connected to a local communication system;
- demultiplexing the signal;
- assigning each of a number of the services/service providers to a virtual broadcast domain;

- routing/switching the service(s)/service provider(s) to the intended end user having selected one or more virtual broadcasting domain(s).

28. A method according to claim 27,
characterized in
that the virtual broadcasting domain comprise Virtual Local Networks (VLAN) based on Ethernet technology, ATM, Token Ring or FDDI or any other link protocol supporting forming of logical domains.

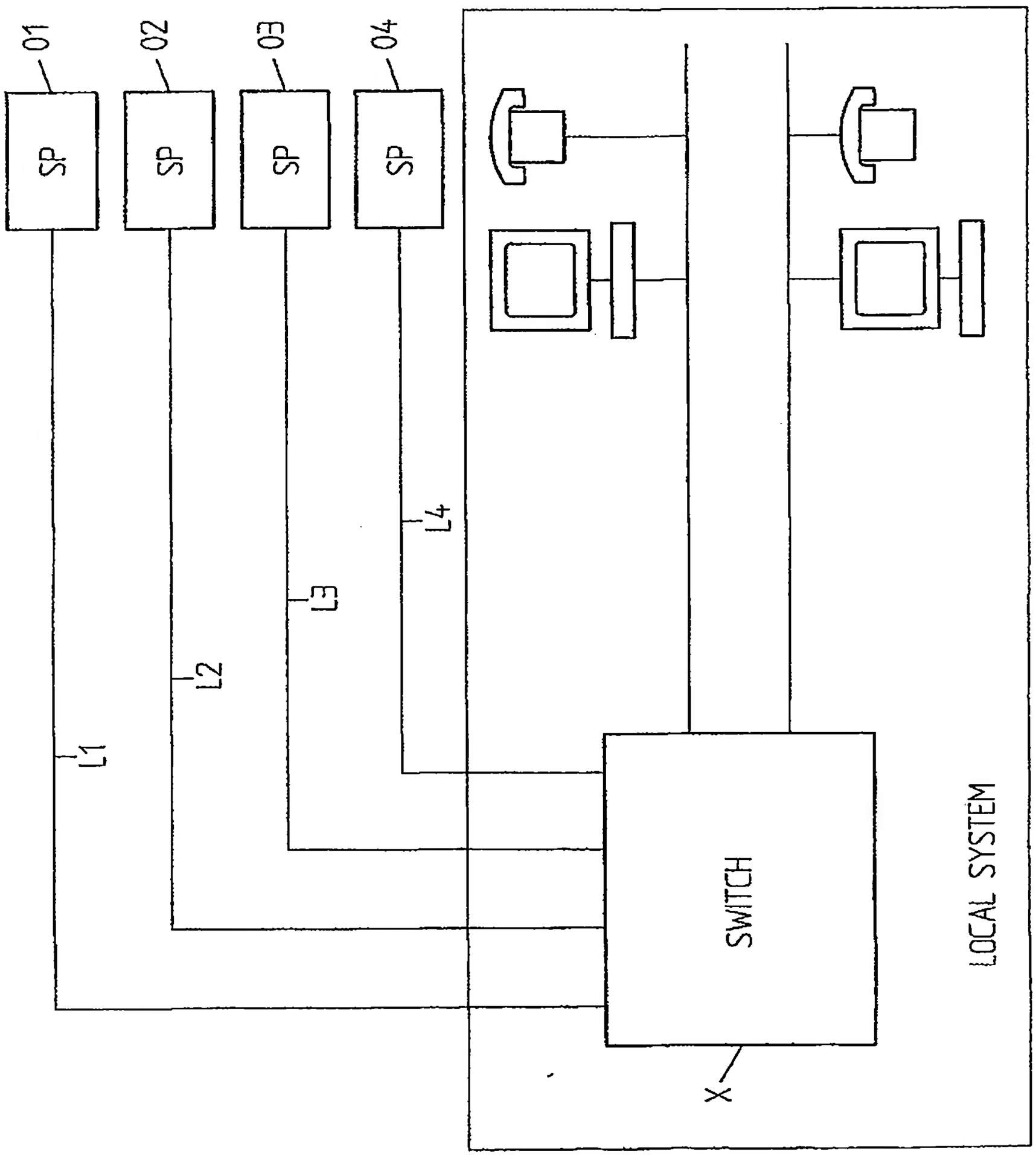
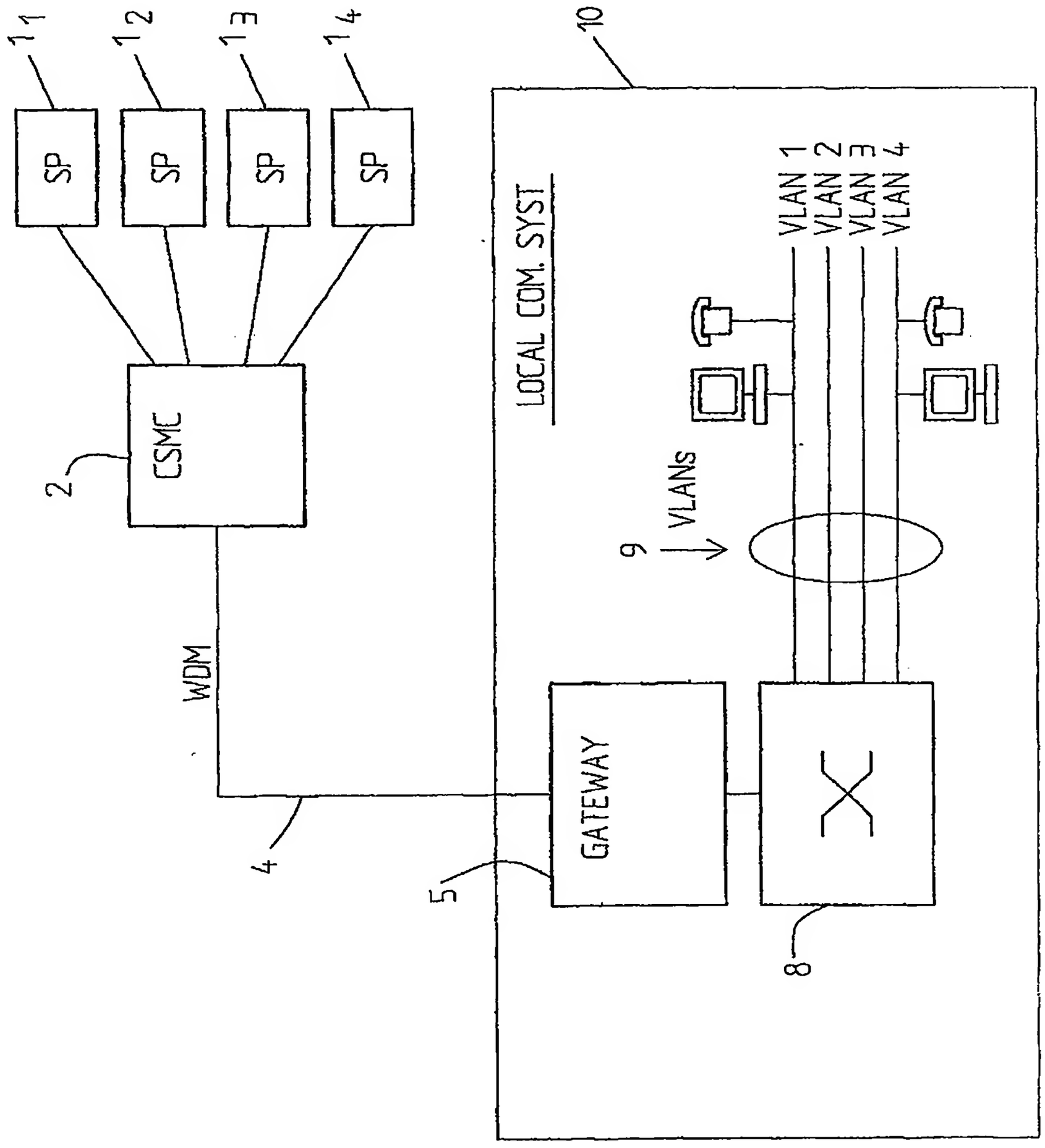


Fig. 1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12
13
14
10
SP
SP
SP
SP
CSMC
2
WDM
4
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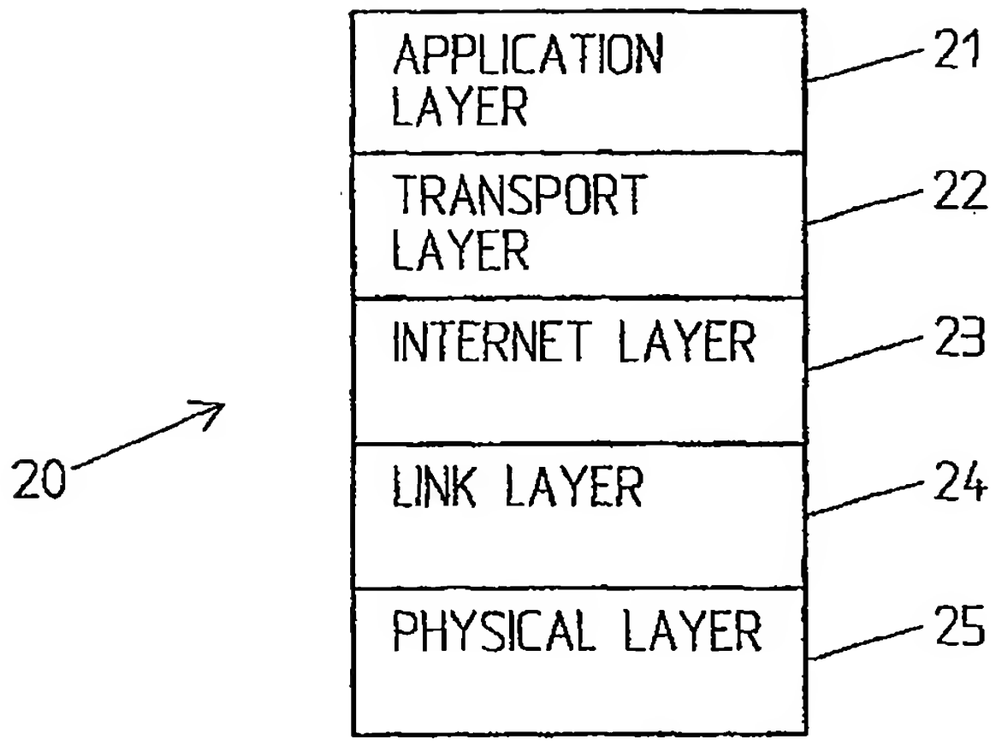
VLAN 1
VLAN 2
VLAN 3
VLAN 4
9
VLANs
GATEWAY
5
8

Fig. 2


APPLICATION LAYER
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TRANSPORT LAYER
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INTERNET LAYER
23
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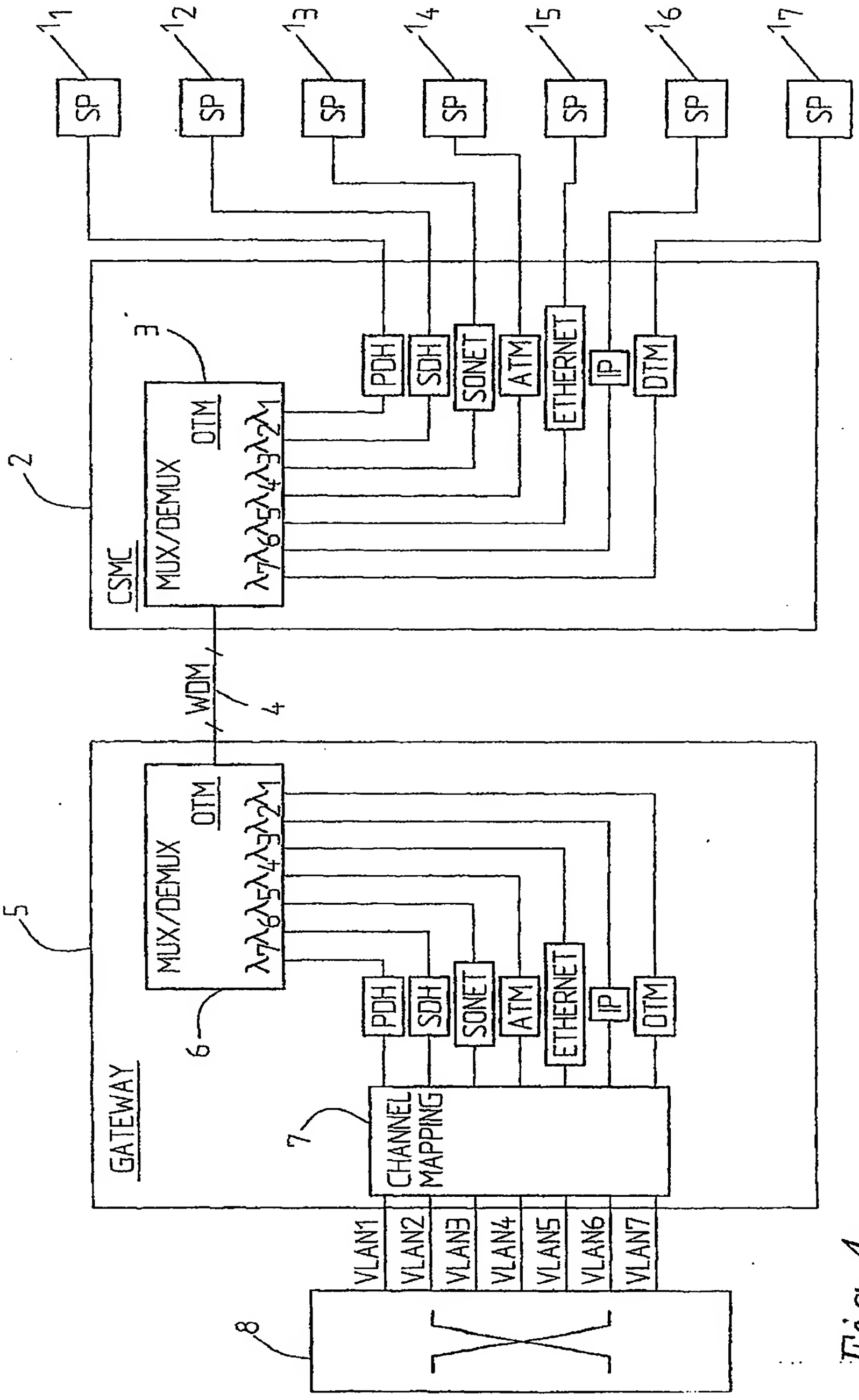
LINK LAYER
24
PHYSICAL LAYER
25

Fig. 3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12
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14
15
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SP
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CSMC
MUX/DEMUX
OTM
λ7λ6λ5λ4λ3λ2λ1
PDH
SDH
SONET
ATM
ETHERNET
IP
DTM
WDM
4
5
GATEWAY
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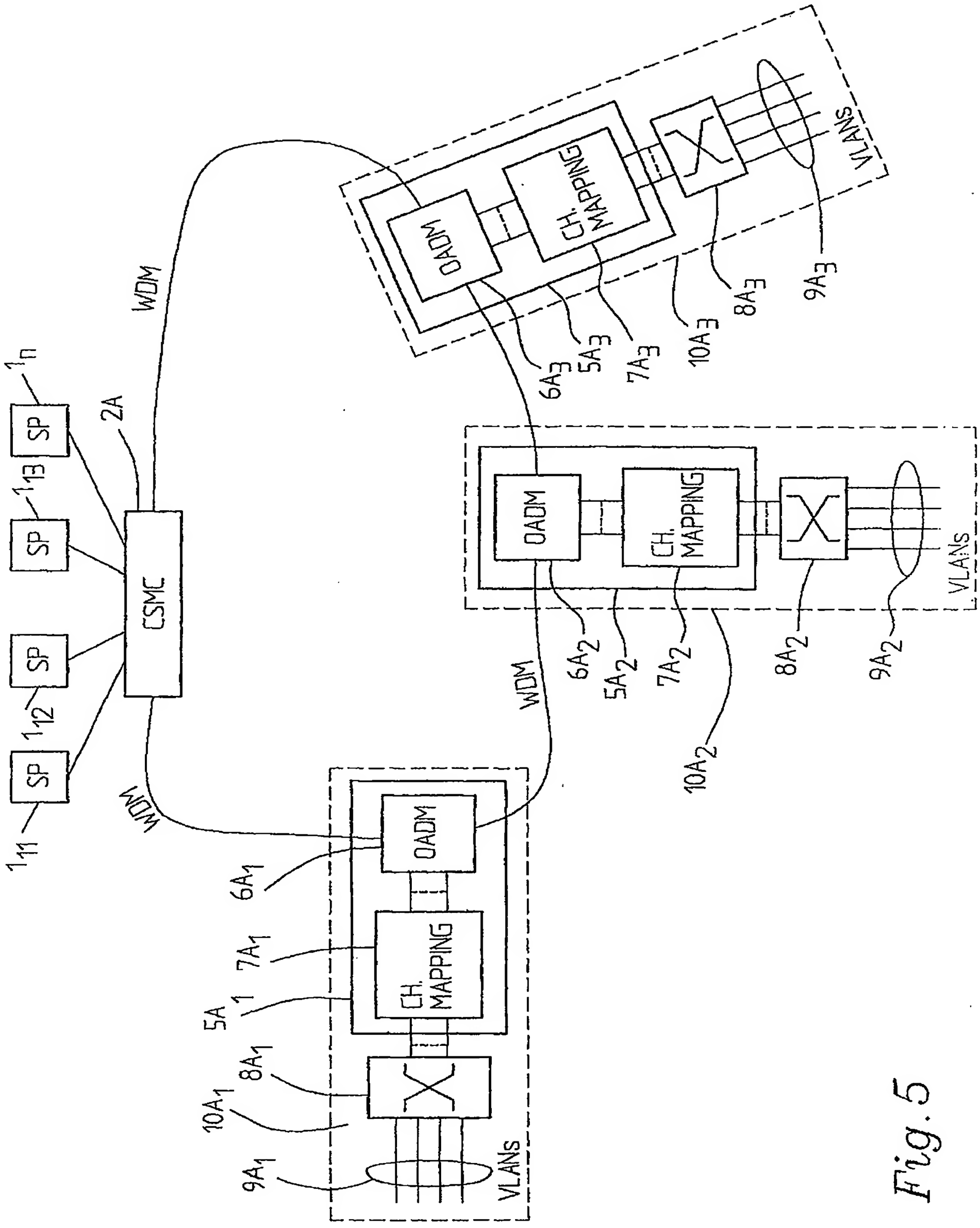
7
CHANNEL MAPPING
VLAN1
VLAN2
VLAN3
VLAN4
VLAN5
VLAN6
VLAN7
8

Fig. 4


SP
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CSMC
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CH. MAPPING
VLANs
OADM
CH. MAPPING
VLANs
OADM
CH. MAPPING
VLANs

Fig. 5

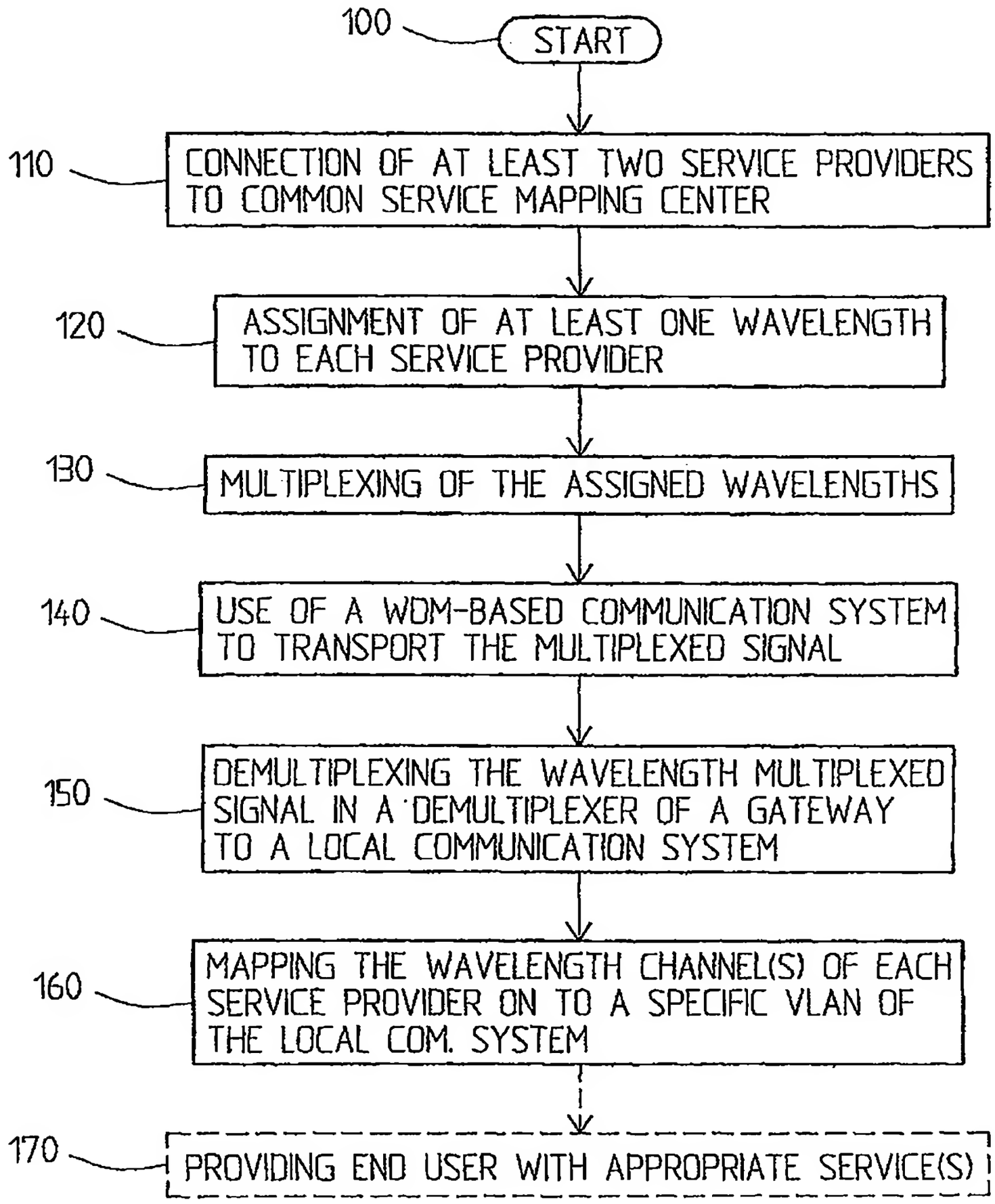
100
START
110
CONNECTION OF AT LEAST TWO SERVICE PROVIDERS TO COMMON SERVICE MAPPING CENTER
120
ASSIGNMENT OF AT LEAST ONE WAVELENGTH TO EACH SERVICE PROVIDER
130
MULTIPLEXING OF THE ASSIGNED WAVELENGTHS
140
USE OF A WDM-BASED COMMUNICATION SYSTEM TO TRANSPORT THE MULTIPLEXED SIGNAL
150
DEMULTIPLEXING THE WAVELENGTH MULTIPLEXED SIGNAL IN A DEMULTIPLEXER OF A GATEWAY TO A LOCAL COMMUNICATION SYSTEM
160
MAPPING THE WAVELENGTH CHANNEL(S) OF EACH SERVICE PROVIDER ON TO A SPECIFIC VLAN OF THE LOCAL COM. SYSTEM
170
PROVIDING END USER WITH APPROPRIATE SERVICE(S)

Fig. 6

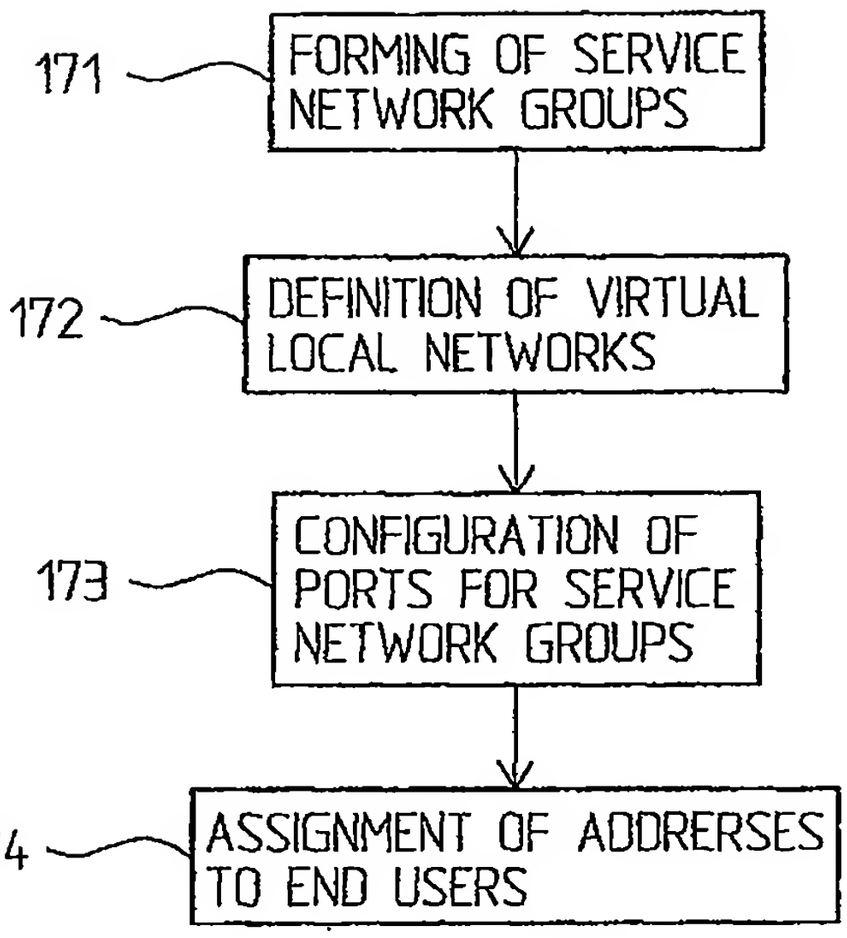
171
FORMING OF SERVICE NETWORK GROUPS
172
DEFINITION OF VIRTUAL LOCAL NETWORKS
173
CONFIGURATION OF PORTS FOR SERVICE NETWORK GROUPS
174
ASSIGNMENT OF ADDRERSES TO END USERS

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 01/01072

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04J 14/02, H04B 10/12, H04Q 11/00, H04B 10/20
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H01J, H04B, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	P.IANNONE et al. High-speed point-to-point and multiple broadcast services delivered over a WDM passive optical network.IEEE Photonics Technology letters; vol.10.Sept.1998.Pages 1328-1330 --	1-28
X	J.YEH ET AL.:DWDM architectures for video on demand transport and distribution. Nanostructures and Quantum Dots/WDM Components/ VCSELs and Microcavaties /RF Photonics for CATV and HFC Systems, 1999 Digest of the LEOS Summer Topical Meetings. 26-30 July 1999.Pages IV25-IV26 --	1-28
X	US 5572347 A (L.BURTON ET AL), 5 November 1996 (05.11.96) --	1-28

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
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"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 Sept 2001	27 -09- 2001
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Jonas Andersson /itw Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 01/01072

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	N.GHANI ET AL.:on IP-over-WDM integration. IEEE Communications Magazine. Vol.38, Issue 3,March 2000.Pages 72-84. --	19,26
A	P.IAMNONE ET AL.:Wavelength-division multiplexed passive optical networks as a multiple service provide access platform. Lasers and Elecctro-Optics Society Annual Meeting, 1997. LEOS ´ 97 10th Annual Meeting. Conference Proceedings.,IEEE. 10-13 November 1997, vol.2. Pages 85-86. --	1-28
A	S.SEN ET AL.:A QoS management framework for 3G wireless networks. Wireless Communications and Networking Conference, 1999. WCNC.1999 IEEE.21-24 Sept.1999.Vol 3, pages1273-1277. --	1-28

Form PCT/ISA/210 (continuation of second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

Information on patent family members

03/09/01

International application No.
PCT/SE 01/01072

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US 5572347 A	05/11/96	AU 653613 B	06/10/94
		AU 2064892 A	04/02/93
		NZ 243741 A	26/10/94

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